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THE
LARYNGOSCOPE.

VOL. LVII NOVEMBER, 1947. No. 11

THE IMPORTANCE OF BEING IGNORANT.

Z. W. COLSON, M.D.,
Lawrence, Mass.

This summer I had the opportunity of reading the remarks of Dr. Mosher when he was made an Honorary Fellow of the American Laryngological Association. Among other pithy statements, he had this to say, "Remember that research, which is the idol of all universities, next to money, calls for imagination on the part of the worker, and especially for the correlating mind."

When I next saw Dr. Mosher I told him that medical education of our day is so crowded and intense for the average student that it tends to standardize and crowd out any imagination which he may ever have possessed, and that I believed an ignorant man would make a better researcher than a learned one. "In other words," Dr. Mosher came back at me, "if we turn our research work over to the Ditch Diggers' Union we might get somewhere."

My lame attempts to make him understand what I meant were not made easy by his comments on my crazy notion, and I soon wondered whether I had been wise in bringing it up at all. Before I left him, however, he instructed me to commit my thoughts to paper on the subject of "Ignorance as an Asset in Medical Research." He seemed to delight in choosing this topic for me, and implied that I had an intimate and personal knowledge of the subject.

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I realize in all seriousness that those who would read a paper on this subject are not ignorant or uninformed. If you were such, this paper could serve no useful purpose.

Dr. Mosher has stated that there are two vital requirements for research—imagination and correlation. In an effort to find a third leg for Dr. Mosher's two-legged stool, I shall have to apply various descriptive names to it, and I shall try to bolster it up so that none will be afraid to risk his weight upon it. The third leg we shall name, for lack of a better title, "Ignorance."

I am too ignorant to define the term "ignorance" in the sense I mean it. Since I am unable to define it, I shall discuss it.

There are many kinds of ignorance, but for the purpose of this discussion we shall consider only two, first, objective ignorance, which is demonstrated by written and oral examinations. This is unimportant as an indication of what a man may or may not accomplish in research. The other — the kind which also contributed to the title of this paper — is subjective ignorance. This is the ignorance which is known only to the worker himself and is his stimulus to the acquisition of knowledge. Subjective ignorance has a strong connotation of humility and some men find in it the Fountain of Eternal Youth. They never grow up to become scholars and continue through their lives to be students.

One saving grace of our present day system of medical education lies with the comparatively few good teachers who refuse to be entirely orthodox themselves and who develop a wholesome agnosticism in their students. They teach what is required to be taught in their classes, sometimes with tongue in cheek. They give their students the impression that they must learn this modicum to pass the course, but that the subject they are teaching has more interesting and important value than the course itself. When the student parts from such a teacher he feels that he has been brought to the gateway of intriguing territory, and that he has just enough

knowledge of the terrain to begin to explore it with interest and appreciation.

During my medical school days I entered the lecture room early one morning, and two young men were sitting in the front row, quizzing each other on the previous lecture in Proctology. One asked, "What are the seven causes of hemorrhoids?" The other answered glibly one, two, three and four, and all were correct. Then he gave the fifth cause. "No," said the questioner, "you are wrong — that is the seventh cause." Both of those boys graduated from medical school with honors. You are not surprised, and neither am I, that they did not develop into research men, nor have they contributed to the advancement of their profession. You may say that such an example is ridiculous and has no place in a discussion of education as conducted in *your* departments. You must admit that something of this type of memory is necessary, even in postgraduate circles. If you are sitting as a board examiner and ask some poor candidate to describe to you the origin, course and distribution of the Vidian nerve, and all he can do is place it vaguely in the vicinity of the sphenoid sinus, it is not going to help him much that he knew the thing once and carried it around in his head for weeks. Of course, while as a young doctor, he is spending two years or so of his life trying to cram for his board examination, you should not expect *productive* thinking from him — he is too busy getting into the groove. Once he is in the groove, he has about as much chance of getting out as a phonograph needle. And, as the needle does, he stays in the groove and repeats every subsequent advance in medical science as it reaches him in his groove. Then, if he is sufficiently alert and reads all the periodicals and retains them, he is a learned man in his specialty, who keeps abreast of his time. You can expect no research from him — he is still in the groove.

At this stage the young man is not entirely hopeless as a researcher, for, after all, his mind is not completely filled with worthless facts, and his training has given him insight into the methods of experimental research. Perhaps he has a problem of his own which interests him, and some day when

he has time he will work on it — but the medical literature is so full that any time he has for study must be spent in trying to keep abreast of new work by others. He has not time to think overmuch for himself, so he adopts the thought of leaders in the field, becomes orthodox and content with the knowledge he has. When this point is reached, you may write off our promising young student as a researcher, for he is headed into a dead end.

The deadening effect of the constant rise in educational standards involves not only students but teachers themselves. The teacher is loaded with an ever increasing load which he must unload in a limited time. This responsibility robs him of any considerable freedom of mental play and transforms him into a stern taskmaster — even against his will.

I recall no better illustration of this than an incident in my early medical school days which involved an outstanding professor of physiology. He was one of the first lecturers I ever heard who had written textbooks on his own subject, and I read them with an interest akin to worship. We were encouraged to discuss with him any individual problem we might have in the field of physiology. When my turn came I said, "So far as I know, the only nerve endings we have in the skin are those of touch, temperature, pain and pressure. If this is true, how do you explain the sensation of itching?" At first there seemed to be the light of interest in his eyes, but he dismissed me with a stern rebuke and told me to spend my time studying what was being taught. It was days before I recovered from this disappointment. I was not troubled with the itch — my heart was hurt — my idol in research had feet of clay.

I would not go so far as to say that a researcher should be entirely ignorant of his problem, but he must be ignorant enough to see in it a problem. Many inventions and many advances in science have come from men who were so ignorant that they didn't know it couldn't be done. To paraphrase Edgar Guest: "The poor man didn't *know* that it couldn't be done, so he rolled up his sleeves and he *did* it."

In speaking to Mr. Howard Kichline, of the North Ameri-

can Cement Co., who has engineered research in ceramics, I asked him what criteria he used in the selection of his research personnel. I posed this question: "Which of these two young men will you select to head a research project? Both are young engineers of equal promise. One is a brilliant student who displays a broad knowledge of the problem, and who readily knows the answers to any phase of the project which is yet to be undertaken. The other man is keenly interested but does not readily know the answers, and is uncertain as to where the investigation will lead." Without hesitation, he replied that he would take the man who knew less but was interested in finding out. He believes that the man who knows or thinks he knows the answers cannot have the same interest as the man who is not so sure.

Few men can possess, individually, the proper balance of ignorance, imagination and correlation to become top-notch researchers, but in this day of teamwork such is not absolutely necessary. The burden of my message to you is to leaven your laboratories with ignorant men who can contribute more than their share of interest and imagination. Then it will be your problem to keep them intellectually honest, correlate their work, and direct their energies so that no discredit will come to you or your institutions.

I do not advocate filling your laboratories with dullards, for ignorance is not dullness — nor does ignorance guarantee imagination. I do maintain that our system of examinations is the poorest possible yardstick for the measurement of these qualities. It does not measure the all too uncommon commodity of common sense. It gives us no line on intellectual honesty. It tells us nothing about versatility. It is no measure of creative ability. It is not an indication of interest, imagination or initiative. All that the examination purports to measure is the amount of knowledge a man can reproduce at the tip of his tongue or the point of his pen at a given hour on a given date. It tells you nothing about how the candidate could answer those same questions even three months later, or how he could answer a slightly different set of questions on that date or any other date. If what I have just said is true or even partially true, it must follow that there are men

classed as ignorant lost to our specialty and turned away from the whole field of medicine, who well might be more of a credit to medical practice and research than some of us who are in it.

One educator has estimated that in a class of 100 medical students, there are perhaps 10 men who possess outstanding imagination. Another believes that even this estimate is probably too high. There can be no question that the men of passing grade who possess this quality to a high degree can contribute more to medical research than a "95 average" man who lacks it. Thus, it would appear that when the annual pruning time comes to the medical school class, it would be wise to hold on to the man who has imagination. It might even be necessary that you accord him the same consideration and coaching which you would give a star athlete to keep him in his class.

Since I have no magic tape measure to replace the examination, I can only urge you to grade down its importance, and you may find that the relative value of the examination is nearer 10 per cent than a 100. Perhaps there might even be a place in medical research for men who, measured by our present educational standards, are "ignorant." I am willing to concede considerable value to the examination. Though it is a poor measure as a yardstick, it is useful as a prod for lagging students and this, perhaps, is its greatest value.

On the same occasion which I mentioned in the first part of this paper, Dr. Mosher referred to tradition as "the most tangible of things intangible." This is particularly true in the field of medical education. The new head of a department in medical school feels that it is his duty to teach all that had been taught by his predecessors, and also to teach the cumulated advances of his time. Tradition seems to teach that nothing shall be subtracted, that everything be added. If this process is continued much longer, we shall be obliged to have two teaching heads for each department — one to teach what was taught to a certain date, and the other to start from there. When this comes to pass, the student will at least reach a professorial age before he will be qualified to practice.

I should be pleased to see one first-class university which has the courage, in the face of tradition, to remove deadwood from its curriculum and, at the same time, keep available in its libraries what has been taught previously.

There will always be a place in medical research for the grade A scholar, even though he is totally lacking in imagination. The presence of a walking encyclopedia is an asset in any laboratory, and such a man is necessary in keeping the record straight; but the real dynamo in research in the future, as in the past, will be the man who possesses a restless, imaginative and searching mind. He must have a mind which is fettered neither by tradition nor by smugness of self-content. His previous school marks are relatively unimportant.

The director of a research laboratory should not be a specialist in any narrow meaning of the term. He should have a broad and universal interest in subjects outside his field. I shall not commit the heresy of suggesting that our medical research should be directed by lay Edisons or Ketterings, but it should be directed by medical men who possess an equal diversity of interest. The elusive key to a problem in medical research may be common knowledge to men who are working in a different and apparently unrelated field. One must have restless imagination and broad interest if he is to correlate the knowledge gained by diverse patterns of thought.

We must bear in mind that in research truth is not the possession of the worker, but his goal. We should not forget that accepted knowledge has been known to raise itself as a barrier to hide the truth — and this unconsciously and certainly without intent.

Ignorance is not antagonistic to knowledge but is a stimulus to its acquisition. Newton expressed this personally when he wrote: "I do not know what I may appear to the world, but to myself I seem to have been only like a boy playing on the seashore and diverting myself now and then finding a smoother pebble or a prettier shell than ordinary, while the great ocean of truth lay all undiscovered before me."

SHIFT OF BONE CONDUCTION THRESHOLD ON OCCLUSION OF THE EXTERNAL EAR CANAL.*†

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INTRODUCTION.

Simple blocking of the external ear canal of the normal ear lowers the hearing threshold for bone conduction; this is an accepted and well known fact.[1] The explanation of this effect in terms of the mechanism of hearing has not been completely settled, and a discussion will follow later in this paper; nevertheless, it is evident that the extent of such a threshold shift will be related to any effective blocking which may already be present, such as may be encountered in stapedio ankylosis. For this reason it was thought that measurements of the shift for cases of normal and impaired hearing might contribute information valuable as an aid to diagnosis.

METHOD OF MEASUREMENT.

The initial requisite was to find a suitable method of closing the ear canal, and for this the magnitude of the threshold shift for normal ears was taken as a measure of the effectiveness of closure. In order to reduce the possibility of hearing in the opposite ear by bone conduction across the head, the opposite ear was masked continuously by air conduction with white noise at an intensity level of 25 db. above threshold. The white noise was produced by amplifying the noise generated by the random ionization of the gas molecules in a conducting thyratron. In making threshold judgments, the observer was seated in a soundproof room and the operator in an adjacent control room. The intensity of the pure tone

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exciting the bone conduction receiver was reduced in steps of 2.5 db. until the observer signaled that the tone could no longer be heard. Each measurement was performed four times, and then a new frequency was used. After values had been obtained at a suitable set of frequencies, the ear was blocked, taking particular care not to disturb the position of the bone conduction receiver, and measurements were again made at the same set of frequencies.

Different substances were used for occlusion in order to find a suitable technique, and among these the following were included: Neoprene N.D.R.C. Ear Wardens, furnished by the Psycho-Acoustic Laboratory, Harvard University, ear defenders produced by the Mallock-Armstrong Co., London, several other types of ear defenders, dry cotton batting, cotton batting wet with water or with glycerine, a cotton batting butt fitted tightly against the ear drum, plasticine, a rubber eye dropper, etc. In most cases measurements were made only at frequencies of 250, 500 and 1,000 c.p.s., since it was soon found that these were the most important frequencies (see below). Each method was tried with several observers, and for a given observer the method which gave the largest average shift was judged to be the best. In this way it was found that wet cotton batting inserted into the external ear canal not only gave results at least as good as those obtained by any other method, but also provided a technique which was simple to apply and which could be endured with a minimum of discomfort to the observer; therefore, this method of occlusion was used in all the succeeding tests.

OCCLUSION SHIFT FOR NORMAL EARS.

There were selected 28 observers of both sexes, between the ages of 18 and 25 years. These were chosen so as to have normal hearing in at least one ear as indicated by: *1.* no history of ear trouble, and *2.* no hearing loss of more than 10 db. over the frequency range 125 to 8,000 c.p.s. as measured in octave intervals with a recently calibrated audiometer. The change of bone conduction threshold on occlusion for the better ear was measured for frequencies of 125, 250, 500.

1,000, 2,000, 4,000 and 8,000 c.p.s., using the method described above, with 25 db. masking on the opposite ear. Fig. 1 shows the air conduction audiogram for a typical normal observer and also gives the bone conduction audiogram before and

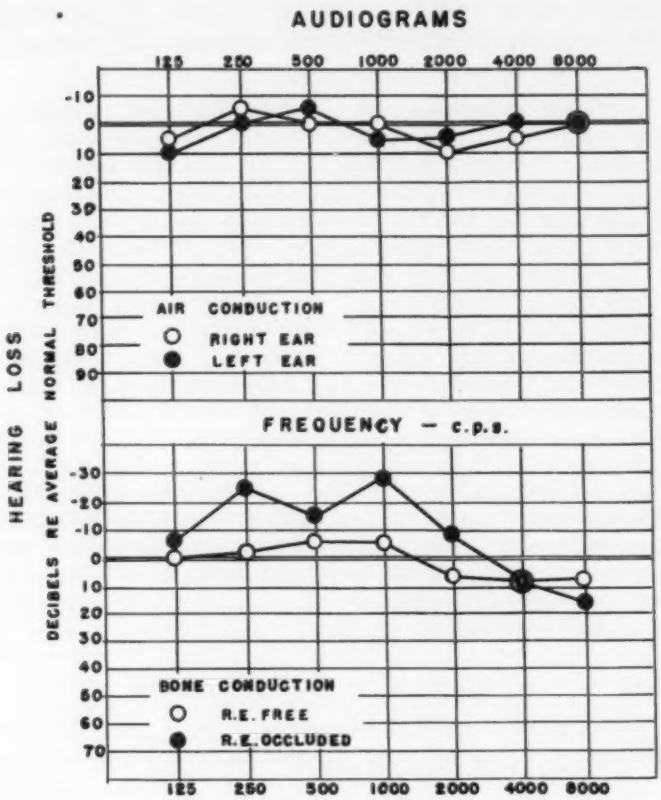

Fig. 1. Normal observer.

after occlusion for the observer. Table 1 shows the occlusion shifts along with their means and standard deviations for each observer tested. Application of the "t" test for statis-

tical significance[2] shows that there is a significant shift on occlusion for all the frequencies from 125 to 2,000 c.p.s. inclusive; however, the largest changes take place at 250, 500 and 1,000 c.p.s., so that measurements at these frequencies should give the most information for the work involved. In order to express the occlusion shift as a single number, it was decided to use the sum of changes at these frequencies as an occlusion index "O." The* value of this index, the mean and the standard deviation are given in column 9 of Table 1. It is seen

TABLE 1. OCCLUSION SHIFT FOR NORMAL EARS.

Observer No.	Threshold Shift—db. Test Frequency—c.p.s. 125	250	500	1,000	2,000	4,000	8,000	Occlusion Index "O" db.
1	18	26	27	16	13	7	6	69
2	—1	21	27	11	2	8	4	59
3	9	23	17	18	3	5	1	58
4	4	10	13	29	16	10	—4	52
5	14	9	20	14	9	1	—4	43
6	16	28	27	21	19	—2	2	76
7	10	24	24	17	3	—3	9	65
8	15	12	19	9	2	1	—3	40
9	29	36	37	18	....	0	—11	91
10	8	23	11	23	16	0	—9	57
11	20	8	14	16	11	9	3	38
12	16	22	24	6	—3	—8	1	52
13	17	7	18	20	10	—19	....	45
14	20	8	7	9	9	0	—2	24
15	15	33	30	28	10	7	—13	91
16	7	17	19	14	2	—5	—5	50
17	7	10	22	26	10	6	0	58
18	25	28	36	9	14	14	12	73
19	4	5	31	21	14	8	7	57
20	10	22	26	15	13	2	11	63
21	7	27	24	22	12	—1	4	73
22	17	29	28	19	6	4	24	76
23	20	25	31	26	15	10	—7	82
24	19	25	24	22	3	9	....	71
25	12	28	39	21	10	6	7	88
26	7	10	8	13	3	1	—4	31
27	18	29	29	23	15	4	—5	81
28	2	14	7	5	5	—4	0	26
Mean	13	20	23	18	9	3	1	60
Standard Deviation	7	9	9	7	6	7	8	19

*Another reason for confining measurements to these three frequencies is that in general it is possible to get readings in this central frequency band, whereas results at lower and higher frequencies are frequently difficult to obtain for cases with marked hearing impairments.

that for the normal cases used here, this index "O" has a value of 60 db. with a standard deviation of 19 db. Then, according to the usual practice, if a value of "O" is found differing from 60 db. by more than twice the standard deviation, *i.e.*, a value less than 22 db. (or greater than 98 db.), one would be justified in expecting a departure from normality.*

OCCLUSION SHIFT FOR CASES WITH CONDUCTIVE DEAFNESS.

The occlusion index was then found for 51 cases which had been previously diagnosed as clinical otosclerosis. Fig. 2 shows the air conduction audiogram of observer No. 45 and the bone conduction audiogram before and after occlusion. The changes of threshold on occlusion for each of the cases and the values of "O" are given in Table 2. As an approximate indication of the extent of the hearing loss in each case, there is also given the sum of the losses at 250, 500 and 1,000 c.p.s. as determined with the audiometer.

From Table 2 it is seen that the average value of "O" is 2 db., with a standard deviation of 5 db. Thus the difference from the normal value of 60 db. is of considerable significance, and we may conclude that for cases of moderate or severe conductive deafness, the shift of bone conduction threshold on occlusion of the external ear canal practically vanishes.

OCCLUSION SHIFT FOR CASES OF PERCEPTIVE AND MIXED DEAFNESS.

Clearly marked cases of pure perceptive deafness are not common, and it was not possible to accumulate enough such data to give statistical results; however, some particular examples follow. In each example the air conduction and the bone conduction audiograms are given to show that there are

*There are factors here which may make the usual criterion invalid. "O" can differ either because the sample chosen was not normal or because the blocking of the ear canal in the test was not complete. This latter factor tends to make the distribution of "O" skew since it always produces a lowering of "O." The magnitude of this effect could be found by examining a large number of cases, but tentatively it will be assumed that "O" as measured above for normal cases is distributed normally.

TABLE 2. OCCLUSION SHIFT FOR CASES OF CLINICAL OTOSCLEROSIS.

Observer No.	Threshold Shift—db. Test Frequency—c.p.s. 250	500	1,000	Occlusion Index "O"	Sum of Hearing Losses at 250, 500 and 1,000 c.p.s.
1	—5	0	3	—2 db.	165 db.
2	7	—1	0	6	115
3	0	0	3	3	178
4	0	2	—2	0	118
5	9	4	12	25	160
6	1	—1	2	2	150
7	0	1	0	1	140
8	1	1	2	4	145
9	2	0	9	11	100
10	1	—1	3	3	185
11	6	6	0	12	130
12	1	—1	—1	4	145
13	—1	0	1	0	200
14	0	—3	0	—3	125
15	—1	2	—1	0	165
16	0	—6	—2	—8	150
17	1	—3	—2	—4	145
18	—2	—3	1	—4	130
19	3	—2	1	2	130
20	0	0	2	2	140
21	—1	0	4	3	150
22	—1	4	4	7	135
23	0	0	2	0	125
24	—5	—5	—10	—20	100
25	—2	5	—5	—2	130
26	0	—1	4	3	145
27	1	1	1	3	180
28	—6	5	7	6	140
29	—1	2	—4	—3	130
30	—4	—1	0	—5	140
31	2	4	0	6	160
32	—5	—2	1	—6	195
33	1	6	1	8	165
34	1	—1	1	1	165
35	4	2	1	7	105
36	0	0	3	3	195
37	0	0	—1	—1	150
38	4	—1	3	6	135
39	0	—2	0	—2	155
40	0	—2	—2	—4	135
41	0	0	2	2	130
42	4	1	2	7	120
43	13	5	0	18	205
44	12	6	2	20	240
45	0	4	0	4	115
46	0	2	2	4	150
47	2	2	2	6	140
48	1	4	—2	3	125
49	0	—1	0	—1	125
50	—3	—1	8	4	170
51	—4	2	1	—1	125
Mean	1	1	1	2	Standard Deviation 5

almost identical hearing losses so that perceptive deafness is indicated (see Figs. 3, 4, 5). The occlusion shifts and the calculations of the occlusion indices for these cases are given in Table 3. These results show that the occlusion index for

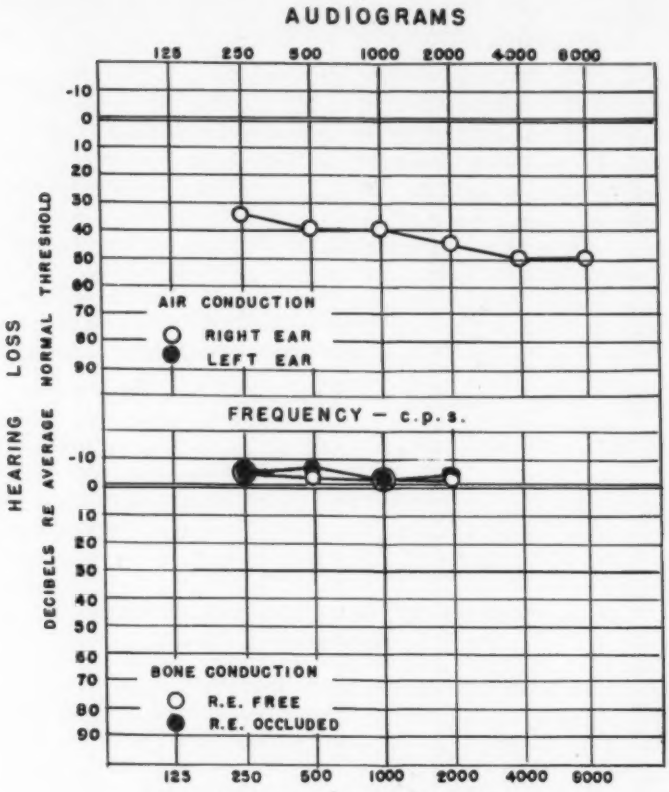

Fig. 2. Observer with conductive deafness.

these cases is not significantly different from that of the normal ear and this is what would be expected for cases where the hearing impairment is not due to stapedio ankylosis.

Finally, there follows a case of mixed deafness, with audiograms as shown in Fig. 6, and occlusion shifts as given in

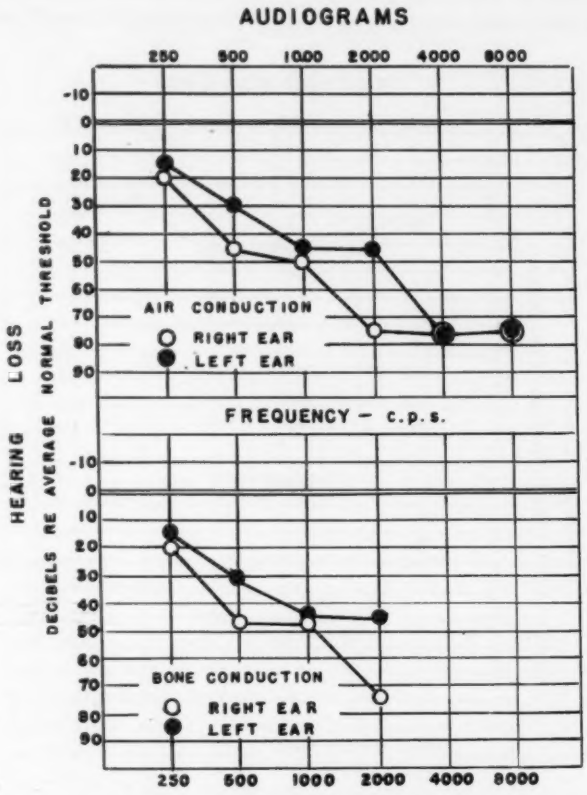

Fig. 3. Perceptive deafness — Case 1.

Table 3. In view of the appreciable conduction loss, it is not surprising that the occlusion index is significantly lower.

DISCUSSION.

According to the usual explanation,[3,4] all hearing, whether by bone conduction or air conduction, arises from motion of

the endolymphatic fluid, the pitch being determined by the locus of stimulation along the basilar membrane. For the normal ear, airborne sounds reach the inner ear through the ossicular chain and the oval window. Bone conducted sounds cause

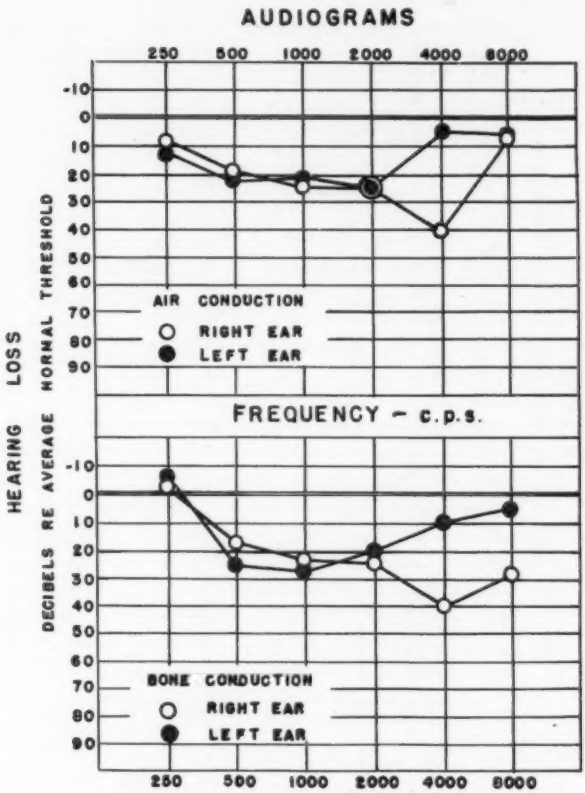

Fig. 4. Perceptive deafness — Case 2.

skull compressions which bring about motion of the fluid in the cochlear labyrinth, due *1.* to the round window having greater mobility than the oval window, and *2.* the additional

endolymphatic connection of the semicircular canals to the scala vestibuli; with the result that the pressure in the scala vestibuli is greater than that in the scala tympani. Thus, in hearing by bone conduction the motions of the endolymphatic

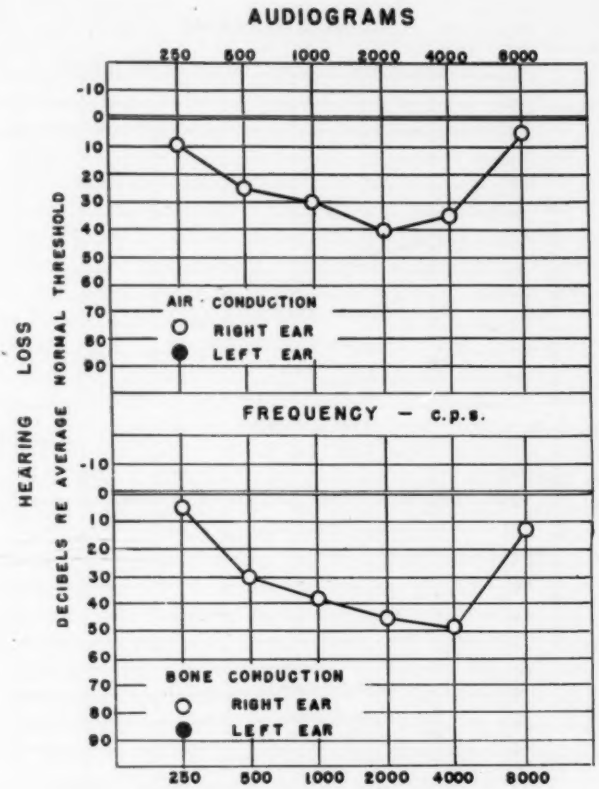

Fig. 5. Perceptive deafness — Case 3.

fluid and the basilar membrane are all exactly the same as those which occur for air conduction; but, whereas in air conduction the round window moves out when the oval window

moves in, and vice versa, for bone conduction the two windows move in the same direction, at the same time.

On listening by bone conduction when the external auditory canal is closed the air in the external and middle ear is

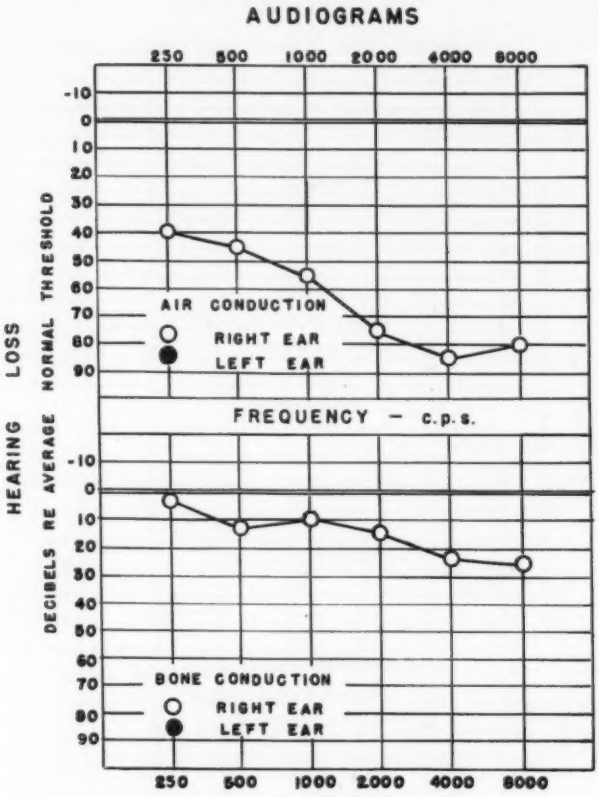

Fig. 6. Mixed deafness — Case 4.

compressed, and the sound is heard through the ossicular chain and the oval window essentially as for air conduction; therefore, there is a lowering of the threshold when the exter-

TABLE 3.

Case No.	Diagnosis	Ear Tested	Occlusion Shift—db. Test Frequency—c.p.s. 250	500	1,000	Occlusion Index "O" db.
1	Perceptive Deafness	Right	19	34	16	69
		Left	15	27	20	62
2	Perceptive Deafness	Right	25	18	0	33
		Left	25	18	4	37
3	Perceptive Deafness	Right	28	19	13	60
4	Mixed Deafness	Left	2	3	5	10

nal ear for normal subjects is occluded.* If, however, the sound path is blocked as in clinical otosclerosis, only the mechanism for bone conduction, described in the previous paragraph, will be effective on closure of the auditory canal, and there will be no shift of the threshold on occlusion. Actually, even a partial fixation of the stapes will prevent loss of fluid pressure by way of the oval window so that for these cases the absolute threshold of bone conduction is lowered; however, this effect is too easily masked by the large variations of bone conduction thresholds which may occur and by the possible presence of nerve degeneration. For this reason it was felt that a difference measurement, as performed above, would be much more likely to yield significant results.

This explanation for the shift of threshold on occlusion is not complete, for it is seen from the results that this shift exists only for frequencies below 4,000 c.p.s. and so far it is not apparent why this should be so. A possible reason may be that the skin, the outer layers of the skull, and the tissue surrounding the auditory meatus are less effective in transmitting vibrations of higher frequencies, as is often the case with substances of this kind, and, therefore, above 4,000 c.p.s. there is no way of exciting the closed air lock formed by the occlusion. Direct measurements of the transmission of sound through the cutaneous structure of the head as a function of frequency are difficult to perform because of the

*The diminution of this air lock may explain why there is no large shift when the canal is occluded by the insertion of a cotton batting butt well into the ear practically up to the tympanus (see "Method of Measurement").

interference of skull resonances, so that the above suggestion must be regarded as tentative at best.

The above mechanism for bone conduction is stated in terms of the resonance theory of hearing and further makes use of the conception of cochlear dynamics, for which Bekesy has given the chief evidence.[5] Pohlman,[6] in a series of papers, has refused to accept this viewpoint.[6] He maintains that the resonance theory is not necessary and that it is possible to explain the mechanism of hearing by having the rods of Corti stimulated directly by the vibrations in the cochlear fluid without any assumptions regarding the differential mobilities of the round and oval windows[4] and without invoking transverse vibrations of the basilar membrane. There undoubtedly is a recent trend to adopt a theory of hearing in which the rods are considered as frequency selective,[7] and if it turns out that these elements can be stimulated without motion of the basilar membrane the whole mechanism of bone conduction and occlusion effects will have to be reconsidered.

SUMMARY.

1. An occlusion index has been defined which shows some possibility of being useful in otological diagnosis. This is the sum of the change of threshold shifts for bone conduction at frequencies of 250, 500 and 1,000 c.p.s., when the external ear canal is occluded with wet cotton batting.

2. For normal ears the occlusion index is 60 db. with a standard deviation of 19 db. For advanced otosclerosis the occlusion index is 2 db. with a standard deviation of 5 db. Limited data on cases of perceptive deafness show that here the index is not significantly different from normal.

3. The change of threshold for bone conducted sound on occlusion is discussed in terms of the theory of hearing by air and bone conduction. Explanations of the effects are given, but these may require considerable modification.

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BILATERAL THYROTOMY FOR CARCINOMA OF THE LARYNX.

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Laryngofissure or thyrotomy is a very simple operation. It would be ideal for carcinoma of the larynx if through its use one could extirpate the tumor in its entirety with considerable healthy tissue around it and at the same time preserve laryngeal function; however, there is always the danger that the tumor may extend so far that the operation is not adequate and recurrence of the tumor may occur. Some surgeons have actually had recurrences; hence, many of them have given up the laryngofissure operation and do laryngectomies only. Other observers with wide experience have had no recurrence of carcinoma after laryngofissure in properly selected cases.

This operation is indicated only when the carcinoma of the larynx is situated in the anterior two-thirds of the cords without fixation. The involved cord should be removed in its entirety and if the tumor has extended close to, or has involved the anterior commissure, part of the opposite cord also should be removed.

The anterior commissure operation of Jackson[1] or Clerf[2] enables one to make a wide dissection and hence a thorough elimination of the entire tumor with a good margin of the surrounding tissue; however, I found that to cut through the thyroid cartilage at the crista, as in Jackson's operation, is very difficult without tearing through the inner perichondrium. If the tumor is situated in this vicinity it may be lacerated. According to Broyles,[3] the extreme anterior ends of the cords are intimately connected with the crista which should also be removed with the cords. In Clerf's operation, the cartilage and attached inner perichondrium are cut away. The larynx

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is then opened blindly with the danger that the incision may be too close to the tumor or the tumor may be actually cut through. The "window resection for laryngeal carcinoma" devised by Lack and modified by Norman Patterson[4] is used only in more extensive carcinoma of the larynx, a condition for which in this country laryngectomy is invariably done. They resect so much cartilage (thyroid and cricoid) that the tumor with the cartilage can be mobilized and removed in one mass.

Where a simple laryngofissure is indicated, as in the case of a very small tumor situated about the middle of the cord, and when only one cord is to be extirpated, the crista should be removed with it. This can be accomplished only by cutting the cartilage somewhat lateral to the midline. Weber, in discussing Dr. Lenz'[5] paper on Carcinoma of the Larynx, says: "In cases in which the lesion extends to the anterior commissure it is my custom to use an operation similar to that of Jackson and Clerf, in which I incise the cartilage beyond the midline, to remove the anterior commissure, including the cartilage, plus the primarily involved side."

The inner perichondrium at the anterior commissure is very hard to separate from the cartilage without tearing. More posteriorly, the perichondrium separates with ease throughout the rest of the larynx. The midline incision in the cartilage, *i.e.*, the crista, is also harder to make, as it is usually more calcified than laterally.

To obviate all these difficulties I adopted an operation which may safely and easily take the place of simple laryngofissure and anterior commissure operations for carcinoma of the larynx as shown by Figs. 1, 2 and 3. The tumor in the third figure may seem too posteriorly situated, but upon phonation (see Fig. 3a) we find a good deal of good tissue between the tumor and the vocal process. In this case, the arytenoid, also, should be removed along with the cord, which will make a safe margin for extirpation. This operation should be done only when there is plenty of healthy tissue (1cm. or more) which can be removed along with the tumor,

Fig. 1.

Fig. 2.

and should not be done when the cartilage has been invaded as shown by fixation of the cords.

The operation is as follows: The patient is prepared and put in position as for a tracheotomy or thyroid operation,

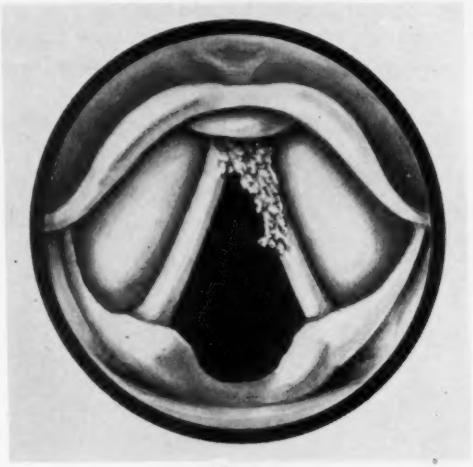

Fig. 3.

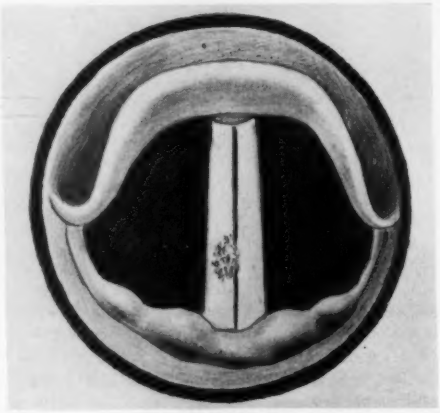

Fig. 3a.

with the head extended somewhat. Anesthesia is local, 1 per cent novocaine at the line of incision. A midline incision is

made from the hyoid bone to just below the cricoid cartilage (see Fig. 4). This incision is carried right down to the thyroid cartilage without dissecting the flaps (see Fig. 5). The external perichondrium is incised in the midline and dissected on each side of the thyroid cartilage for 0.5 cm. (see Fig. 6). The whole cartilage is then incised vertically on

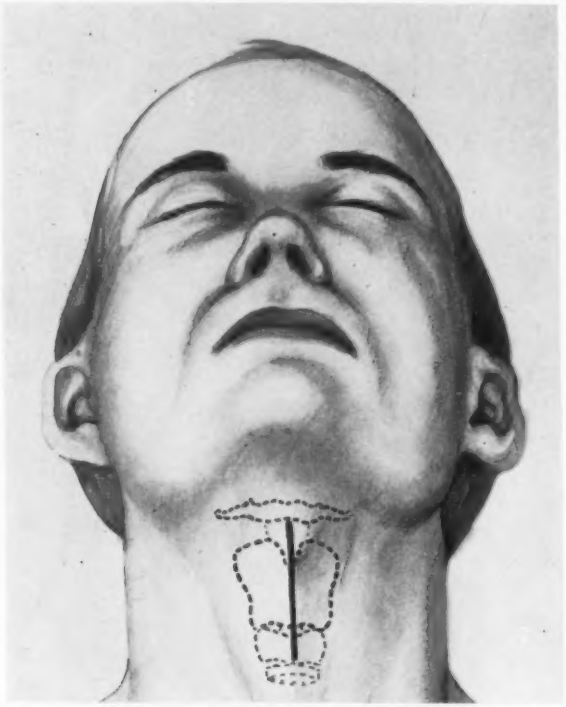

Fig. 4. Midline incision—from hyoid bone to just below the cricoid cartilage.

each side at this distance from the midline (see Fig. 7), leaving the crista with 0.5 cm. of cartilage on each side, exposed or denuded of perichondrium. (These incisions are made with a semisharp knife and do not extend *through* the *inner* perichondrium. This is very easily accomplished, since usu-

ally the cartilage is not calcified in that vicinity, except at the lower border, and the inner perichondrium is not adherent; hence, the inner perichondrium at the lower border can be separated, and then one can cut through the cartilage at the lower border with a heavy shears.) The inner perichondrium on the involved side is next separated from the rest

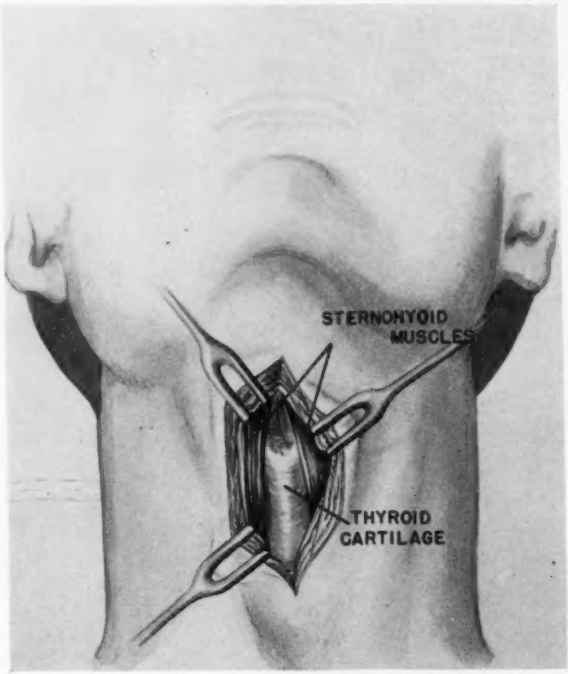

Fig. 5. Exposure of cartilage without dissecting the flaps.

of the ala of the thyroid cartilage, throughout its entire extent (see Fig. 8). On the uninvolved or lesser involved side, the separation of the inner perichondrium may be carried on further than the incision of the cartilage, or not at all, according to the location of the tumor. The cricothyroid membrane is penetrated by a hypodermic needle and a few drops of ponto-

caine 2 per cent are instilled into the larynx. This prevents the patient from coughing when the larynx is opened. With the aid of suction, a horizontal incision is then made into the membrane along the upper edge of the cricoid cartilage. The interior of the larynx is then further anesthetized by swabbing with 2 per cent pontocaine. With a blunt end straight scalpel, such as one uses in rhinoplasty, the incision is car-

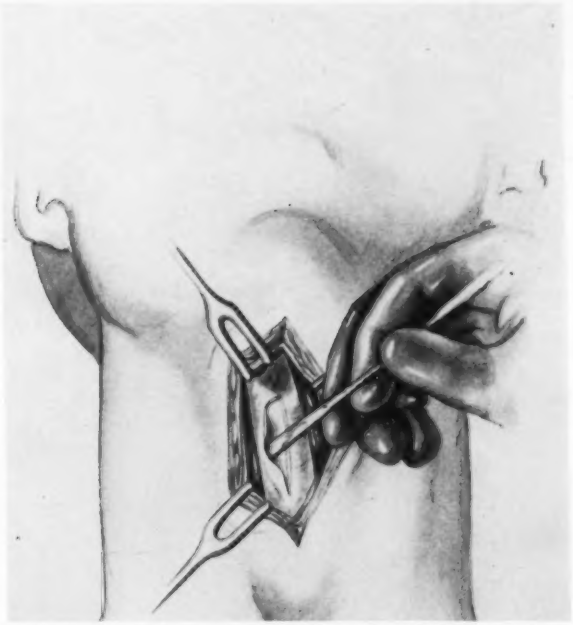

Fig. 6. External perichondrium incised in the midline and dissected on each side for 0.5 cm.

ried up on the uninvolved or lesser involved side through the freed inner perichondrium clear up to the top of the thyroid cartilage, then across the thyroid notch to the opposite side (see Fig. 9). The crista, with the 0.5 cm. of cartilage on each side, with the inner periochondrium attached, is folded over, like opening a door, and the interior of the larynx exposed.

A sponge with a string attached is placed in the pharynx to prevent saliva from entering the wound (see Fig. 10). Then, with a straight and curved scissors, the entire mass, which was previously freed and is now held in position by the upper rim of the thyroid cartilage on the involved side and posteriorly by the arytenoid, is cut out. This mass consists of the

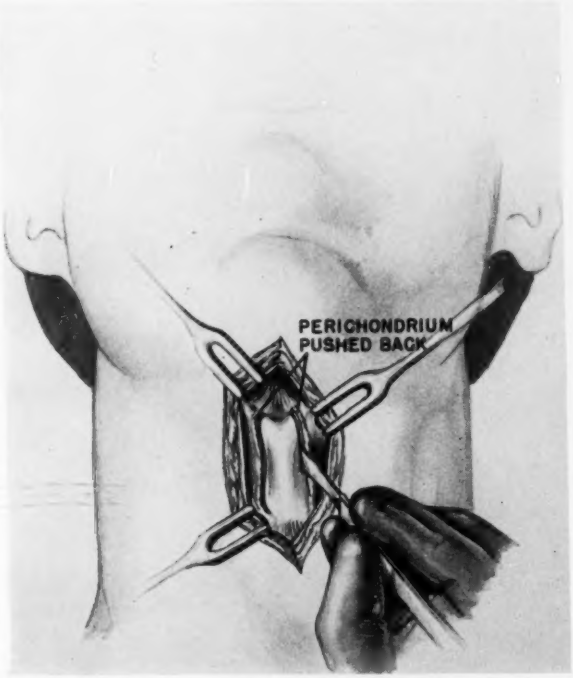

Fig. 7. Cartilage incised vertically 0.5 cm. on each side.

crista with the anterior commissure, ventricular band, true cord and tumor, with or without the arytenoid, and the cricothyroid membrane (see Fig. 11). The larynx remains widely open so that bleeding points can be easily seen and controlled, either by pressure or by coagulation. When the wound is dry, it is closed by suturing the outer perichondrium and the mus-

cles with catgut, and the skin sutured over that (see Figs. 12 and 13). No tracheotomy tube is used and none inserted after the operation, unless bleeding cannot be stopped without packing. In the operations in which I have followed this technique the bleeding was slight and easily controlled. The neck is dressed as usual, and the patient put to bed in a semi-recumbent position, making cough and expectoration much

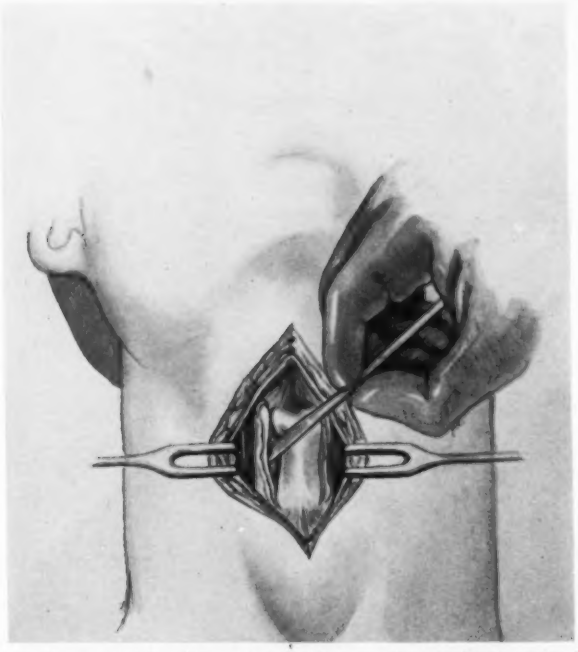

Fig. 8. Inner perichondrium separated from the cartilage entire length on involved side of thyroid cartilage.

easier. No opiates are given before, during or after the operation.

Penicillin, started just before the operation, is continued for four days in usual doses. No feeding tube at this stage is used and nothing by mouth is given for 24 hours after opera-

tion. In the meanwhile, the patient is supported with glucose and amigen intravenously. Strict silence is observed by the patient for the next two weeks. On the second day after the operation, he is allowed to try to swallow sterile normal saline solution and if he swallows without regurgitation, he is given sterile liquids for the next 24 hours. After the second post-

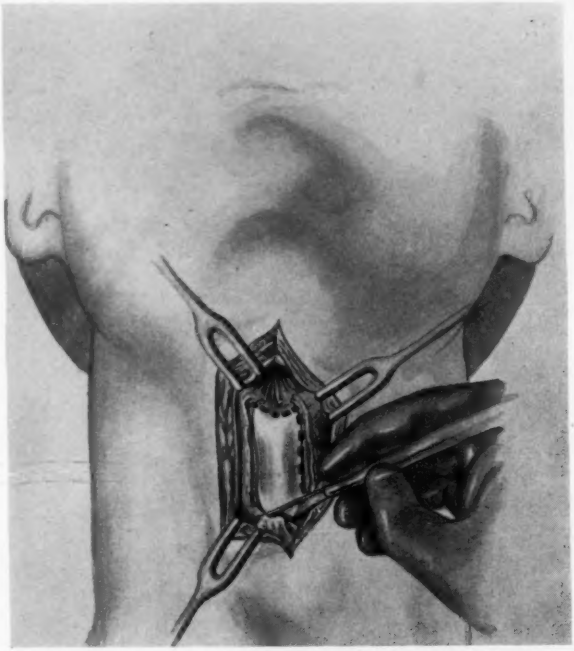

Fig. 9. Incision across cricothyroid membrane up the inner perichondrium of the uninvolved side across the thyroid notch to opposite side.

operative day, if swallowing is good, the patient is given full liquids for the following two days. Then, if there is no pain upon swallowing, a liberal diet is given. The patient is not restricted to bed, but allowed to move around, even in the first few days, and is discharged from the hospital in about 10

days' time. The larynx is periodically examined, for several months, for granulations and infections.

There were no granulations in the cases reported in this paper; however, if granulations should appear, they may be removed with cold forceps and their bases cauterized with the electric cautery, as after any laryngofissure operation.

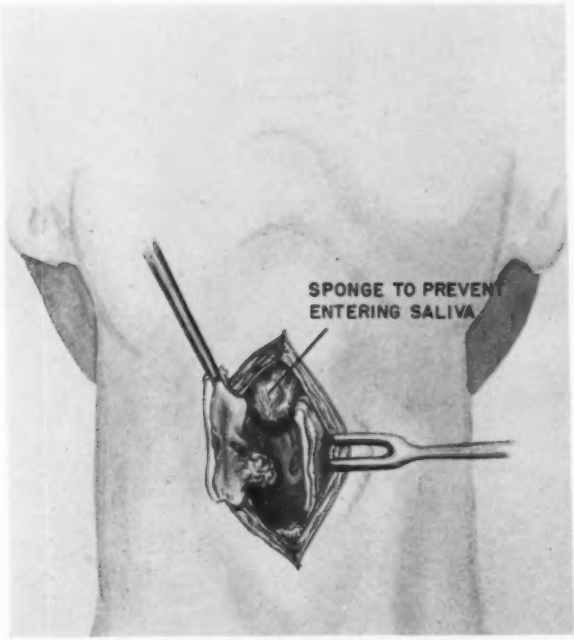

Fig. 10. Anterior commissure with the inner perichondrium folded over (like opening a door) and interior of larynx exposed. Entire mass excised.

This prevents the recurrence of granulations. Granulations should be examined microscopically for malignancy. As a rule, the patient regains a good useful voice in about three weeks and is discharged from active treatment; of course, he is kept under observation.

The advantages of this operation are as follows:

1. Short incision, without dissecting the flaps;
2. Easy cutting through the cartilages without injuring the inner perichondrium;
3. Easy dissection of the inner perichondrium without danger of cutting through the tumor or too close to the tumor;

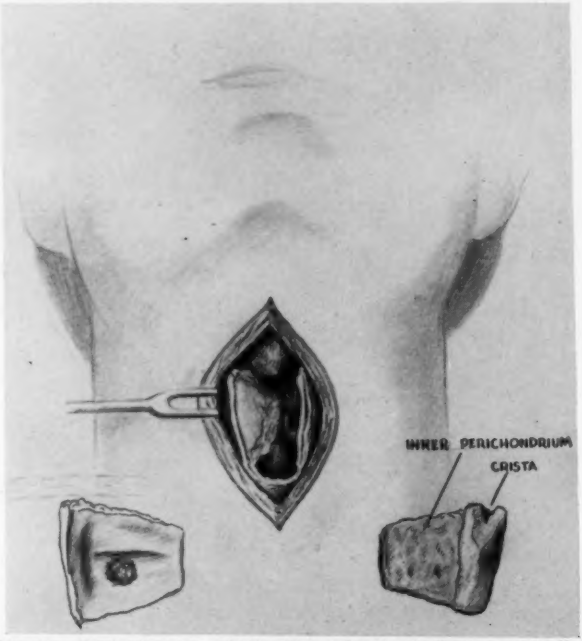

Fig. 11a. Excised mass on both sides. Bleeding in larynx controlled.

4. The crista with the anterior commissure is removed, along with the cord or cords;
5. Minimum amount of work done after larynx is opened;
6. No tracheotomy tube necessary;
7. Good exposure with the least retraction of cartilages;
8. A more thorough extirpation of the tumor along with

a good deal of surrounding tissue *en masse* without mutilation;

9. Bleeding easily controlled;

10. Healing, with little or no reaction and quickly accomplished;

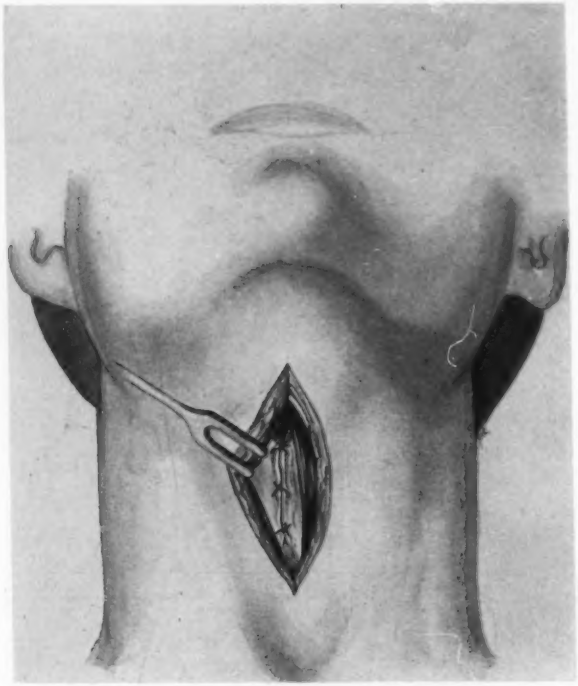

Fig. 11b. Suturing of outer perichondrium and muscles.

11. Stenosis is not apt to occur, as the cartilages have a tendency to spread apart rather than to collapse;

12. This method can be used in all cases of carcinoma of the larynx suitable for laryngofissure and anterior commissure operations.

CASE REPORT.

R. C., age 49, white male, came to me May 8, 1947, complaining of hoarseness for eight months, but had no pain or discomfort. He was examined by the internist and his health was found to be absolutely perfect in all other ways. The larynx presented an irregular mass growing out of the anterior half of the right vocal cord and extending almost to the anterior commissure, but not quite reaching it. This was ulcerated

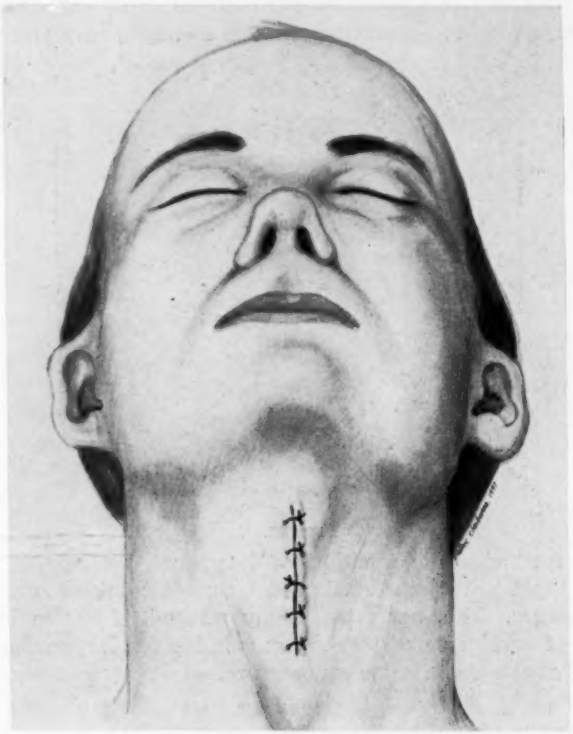

Fig. 12. Skin closure.

in part, but there was no fixation of the cords (see Fig. 1). Biopsy by the indirect method was taken and squamous cell carcinoma was found. One week later, he was operated upon, following the technique herein described, with removal of the whole right cord and one-third of the left vocal cord, together with the crista, cricothyroid membrane and the corresponding ventricular bands in one mass. He had very little bleeding, which was easily controlled by pressure and coagulation. He swallowed well the following day and made the quickest recovery I ever had after

a laryngofissure. He was discharged from the hospital on the tenth day and had no further trouble. The wound healed per primum and the larynx healed smoothly and without granulations. Fig. 13 is a drawing of the larynx six months after operation. He has gained a good deal of weight and talks very well. Two more patients were operated upon since then, with equally good results.

CONCLUSIONS.

A bilateral thyrotomy for the extirpation of carcinoma of the larynx is here presented. This is a simple, easy and thor-

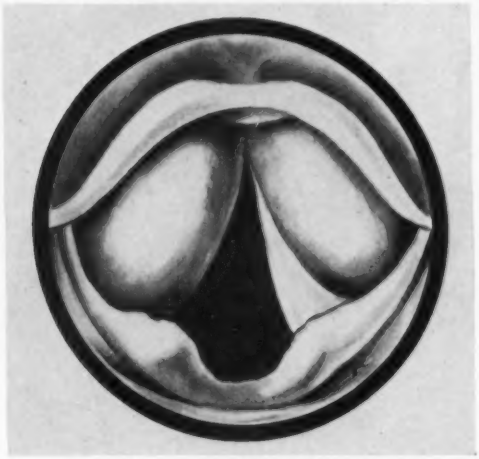

Fig. 13.

ough method of extirpation of laryngeal carcinoma. The advantages are enumerated, and I cannot think of any disadvantages. This operation is my method of choice in all cases of carcinoma of the larynx suitable for laryngofissure, either simple or anterior commissure.

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CHOANAL ATRESIA.

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Congenital atresia of the posterior nares has long been recognized and various forms of surgical treatment have been advocated. The subject has been extensively surveyed and summarized by White,[1] Colver,[2] Cinelli,[3] Kazanjian,[4] Ruddy[5] and others.[6,7]

The reason for adding this case to the literature is twofold: first, the importance of the clinical history which in itself should have suggested the diagnosis in this case, and, second, the visualization of the atresia by means of lipiodol and X-rays.

Case Report: The patient is a 15-year-old American boy whose mother stated that soon after his birth he had marked difficulty in breathing and that he could nurse only when held in certain positions. He has had almost continuous "colds" with profuse purulent discharge in the right nares, which he is unable to expel. Recently his condition has been greatly aggravated by swimming.

Examination on June 8, 1945, revealed a robust youth whose voice had a nasal twang. A deflected septum almost completely occluded the left side. The right nasal cavity was filled with thick mucopurulent discharge. After complete shrinkage it was impossible to pass an applicator into the nasopharynx. All of the sinuses were dark to transillumination. Nasopharyngeal examination revealed no adenoid tissue. The left choana appeared normal, while the right was closed by a hard bony wall in the center of which was a small dimple. The tonsils were absent. Lipiodol instillation into the right nostril showed the location and the extent of the atresia (see Fig. 1).

Treatment: On June 19, 1945, a preliminary submucous resection of the septum was done under local anesthesia. On July 16, 1945, under general anesthesia the right posterior choana was opened by means of chisels, ronguers and rasps. An obturator of rubber tubing was left in site for about a month (see Fig. 2).

The patient was greatly relieved for about 18 months, when recurrent signs and symptoms of obstruction demanded further surgical intervention.

Accordingly, on Feb. 7, 1947, he was operated upon after the manner suggested by Kazanjian; that is, the posterior septum was removed by means of an electrosurgical knife.

To date, seven months after the second operation, his breathing is comfortable and his nose is clean and dry.

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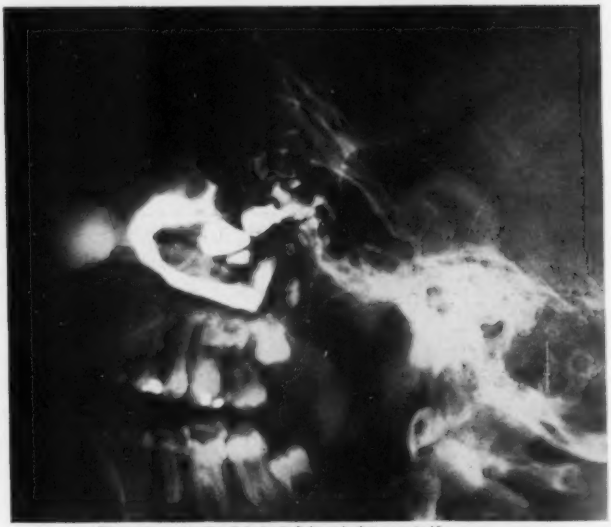

Fig. 1a. A. P. Lipiodol in right nostril.

Fig. 1b. Lateral, showing posterior occlusion.

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Fig. 2. Lateral, showing obturator in place.

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DEEP NECK INFECTION, SUBMAXILLARY TYPE, IN A TWO-AND-ONE-HALF MONTHS OLD INFANT.

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The rare occurrence of the submaxillary, or Ludwig's angina, type of deep neck infection, in such a young infant, prompts the reporting of this case. The usual neck infection in an infant or young child is the well known retropharyngeal abscess, the symptoms of which may be very similar when accompanied by respiratory difficulty.

History: The patient, a white female infant, two and one-half months old, had a normal birth and no illnesses except that a month or so previous she had difficulty with her feedings, resulting in intestinal inflammation with diarrhea. The formula was changed several times by the family physician. Several weeks before admission to the hospital she had a mild upper respiratory infection with nasal discharge. Three days prior to admission this upper respiratory infection suddenly increased in severity, and on March 8, 1947, she was admitted to the hospital. Temperature on admission was 105° F. She was seen by a pediatrician, who placed her in an oxygen tent, administered penicillin and sulfadiazine, and ordered frequent aspiration of secretions from the nose and throat. He reported coarse rales in the large respiratory tubes, and decreased breath sounds in the right lower lobe posteriorly. Two days later, March 10, I first saw her in consultation, and the examination was as follows:

Physical Examination: Head and neck in moderate extension; color pale. Profuse mucopurulent discharge in the nose and mouth, and a well established dyspnea with noisy breathing and retraction of the suprasternal and infrasternal regions with inspirations. The infant was obviously hungry, but refused to take the bottle. There was trismus, with the tongue displaced upward against the palate and somewhat swollen. The sublingual tissues showed a considerable degree of edema. The submental and submaxillary regions and upper adjacent part of the neck were swollen, tender and tense. The character of breathing was similar to that present when a retropharyngeal abscess causes obstruction of the larynx.

Lateral neck radiograph disclosed that there was no widening of the shadows of the retropharyngeal tissues, but that there was a very definite increase in size of the shadows of the tongue base with obliteration of the space between the tongue base and the epiglottis and with backward displacement of these structures.

Inspection of the pharynx was impossible because of trismus and swelling of the tongue. The swelling of the submaxillary regions was

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not fluctuant, nor was there any edematous pitting elicited on finger pressure. No individual groups of lymph nodes could be palpated.

A tentative diagnosis of submaxillary abscess was made. The possible presence of retropharyngeal abscess was tentatively ruled out on the basis of the radiographic evidence.

On March 10, the patient was taken to the operating room, with two objectives in mind—to relieve the dyspnea by tracheotomy and to drain the suspected abscess. A slowly developing anoxia from obstruction of the airway and from accumulating secretions in the tracheobronchial tree was considered imminent.

Operation: Under local anesthesia a tracheotomy was performed and a tube inserted. After waiting a few minutes to allow recovery from any anoxic effects, and again under local anesthesia, a large sublingual and submaxillary abscess was evacuated through the midline suprahyoid approach. Culture from this abscess proved to be staphylococcus aureus hemolyticus. Cultures previously taken from the nose and mouth showed staphylococcus aureus, streptococcus viridans and Klebsiella pneumoniae.

Postoperative Course: During the night, following the operation, the infant slept at long intervals with quiet and unobstructed breathing. During the waking intervals there was considerable coughing and restlessness. In the morning she took all of the regular feedings without difficulty. Her color was good, and there was spontaneous and normal bowel movement.

Drainage was discontinued after one week, and the tracheotomy tube was removed on March 26, the sixteenth postoperative day. The patient was discharged from the hospital on March 29.

Follow-up: The patient has been entirely well since discharge from the hospital.

COMMENTS.

1. This case exemplifies the difficulty in making an exact diagnosis until after complete restoration of the airway by tracheotomy.

2. It shows the valuable help obtainable from a good lateral neck radiograph taken with soft parts exposure time.

3. Because of inability to suck and swallow, there was considerable dehydration and some undernourishment. Transfusions supplied some of these requirements. Nursing was resumed in less than 24 hours after operation.

4. During the first four days of the illness, before the drainage operation, the temperature continued high despite 25,000 units of penicillin every three hours. Three days after operation the temperature reached 99° F. and did not rise again.

5. The lymphatic tissue at the base of the tongue (lingual tonsil) was considered the portal of entrance of the infection. At two and one-half months of age the dental region may be ruled out. There is a possibility that the faucial tonsil may have played a rôle.

6. The bacteriological findings disclosed what has been observed in many neck infection cases; namely, that the invader of the neck is usually one of the variety found in cultures from the mouth and throat.

7. This is the youngest patient that I have ever seen with Ludwig's angina type of infection.

LETTER TO THE EDITOR.

To the Editor: The article by Fox and West in the August, 1947, issue of THE LARYNGOSCOPE (57:564), entitled: "Vitamin K and Late Tonsillar Hemorrhage," prompts the following comments:

These investigators challenged the evidence furnished by us some time ago (*Arch. Otolaryngol.*, 42:14, 1945) that salicylate-induced hypoprothrombinemia is an important factor in the causation of late tonsillar hemorrhage and that the incidence of secondary bleeding can be appreciably reduced by the concomitant administration of vitamin K. In view of several discrepancies in the figures presented by Fox and West, it is not quite easy to follow the details of their data.

Yet, the following appears from the results obtained in three groups of patients: The incidence of late hemorrhage in Group I, including patients who used Aspergum "throughout the postoperative period," was 8.5 per cent. The administration of vitamin K along with the Aspergum to patients in Group II had no protective effect against this postoperative complication; however, the incidence of secondary bleeding was reduced to 1.1 per cent in Group III consisting of patients who were not permitted to chew gum containing acetylsalicylic acid and did not receive vitamin K.

Fox and West state that "a comparison of Groups I and II in this series fails to reveal any protective action afforded by vitamin K. . ." This is true of the cases reported by these workers, but their conclusion is unwarranted that hypoprothrombinemia is no cause of late tonsillar bleeding, particularly in view of the stated fact that no prothrombin determinations were carried out. It seems not difficult to account for the differences in their findings and in ours. The average consumption of Aspergum during the postoperative period by the patients studied by Fox and West was 16 tablets, equivalent to 56 gr. of acetylsalicylic acid. This amounts to an average daily intake of 8 gr. = 0.52 gm., a quantity which is too

small to decrease prothrombin activity, except perhaps in the hypersensitive patient. It is small wonder, then, that vitamin K was seemingly ineffective! The smallest daily dose of acetylsalicylic acid we used was 1.2 gm., but mostly it was 2.4 gm. This is between 2½ times and almost five times as much as the dose used by Fox and West. Thus, the data presented by these authors in no way disprove our concept of salicylate-induced prothrombinopenia being an important etiologic factor. Just one conclusion is warranted from their work; namely, that Aspergum, even at dosage levels not productive of a hypoprothrombinemic state, predisposes to bleeding caused by some other mechanism, but this, quite obviously, cannot be prevented by vitamin K. The authors suspect that the hemorrhages encountered are due to some local effect of the Aspergum on the wound.

Ersner and co-workers (*Ann. Otol., Rhinol. and Laryngol.*, 43:114, 1934) furnished evidence that acidification, as by acetylsalicylic acid, renders ineffectual the coagulatory properties of saliva. For this reason, they cautioned that "the chewing of Aspergum or the use of aspirin mouth washes and gargles should be avoided following tonsillectomy."

Had Fox and West given Aspergum in amounts likely to interfere with prothrombin production, vitamin K would have overcome the ensuing hypoprothrombinemia; nevertheless, the antihemorrhagic vitamin would not have reduced the incidence of bleeding, as was the case in our studies now comprising over 600 patients receiving acetylsalicylic acid internally in combination with vitamin K, since Aspergum apparently also has a local untoward effect on the tonsillar wound. The experiments by Fox and West have elucidated this, but, as stated above, they in no way disprove our findings.

(Signed) HARRY NEIVERT, M.D., New York.

HEARING AIDS ACCEPTED BY THE COUNCIL ON PHYSICAL MEDICINE OF THE AMERICAN MEDICAL ASSOCIATION.

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Maico Type K; Maico Atomeer.

Manufacturer: Maico Co., Inc., North Third St., Minneapolis, Minn.

Mears Aurophone Model 98.

Manufacturer: Mears Radio Hearing Device Corp., 1 W. 34th St., New York, N. Y.

Microtone T-4 Audiomatic.

Manufacturer: The Microtone Co., 4602 Nicollet Ave., Minneapolis, Minn.

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Zenith Radionic Model A-2-A; Zenith Radionic Model A-3-A; Zenith Radionic Model B-3-A; Zenith Model 75.

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THE AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC.

The coming Section Meetings will be held as follows:

Eastern Section—Jan. 16, 1948.....New York, N. Y.

Middle Section—Jan. 19, 1948.....Columbus, Ohio

Southern Section—Jan. 23, 1948.....New Orleans, La.

Western Section—Jan. 31-Feb. 1.....San Francisco, Calif.

(The mid-winter Council Meeting will be held in New York, N. Y., on Jan. 17, 1948.)

Arrangements have been made to hold the Annual Meeting at Chalfonte-Haddon Hall in Atlantic City on April 7, 8 and 9, 1948. The mornings will be devoted to scientific sessions; the afternoons will be left free.

The American Otological Society and the American Laryngological Association are planning to hold their meetings at Old Homestead, Va.—the former on April 12 and 13, 1948; the latter on April 14 and 15, 1948.

This plan to have a three-day Triological meeting with free afternoons and an interval of two days between the Atlantic City and the Old Homestead meetings is projected in order to relieve the strain of concentrating within one week the combined activities of these three societies. Address any inquiries to Dr. C. Stewart Nash, Secretary.

DIRECTORY OF NATIONAL OTOLARYNGOLOGIC SOCIETIES.

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Secretary-Treasurer: Dr. K. C. Brandenburg.
Committeeman: Dr. Benton N. Colver.
Meeting: Los Angeles County Medical Association Building, 1925 Wilshire Boulevard, Los Angeles, Cal.
Time: 6:00 P.M., fourth Monday of each month from September to May, inclusive.

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Secretary: Dr. Norman N. Smith, 291 Whitney Avenue, New Haven 11, Conn.
Meeting: New York City, New York Academy of Medicine, Nov. 17, 1947.

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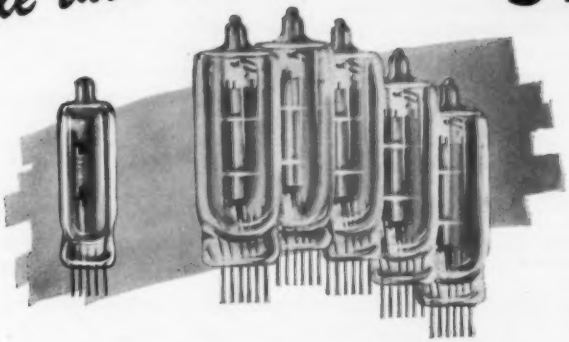

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